On-line monitoring of microbial drinking water quality – on site tests

Albrechtsen, Hans-Jørgen; Arnedo, M. J.; Appels, Joep; Baquero, D.; Galofre, B.; Lindhardt, Bo; Lee, Carson Odell; Wagner, Florian Benedikt

Publication date:
2018

Document Version
Version created as part of publication process; publisher's layout; not normally made publicly available

Abstract for NORDIWA 2018 - 11th Nordic Drinking Water Conference
11th to 13th June 2018, Oslo, Norway

On-line monitoring of microbial drinking water quality – on site tests

H-J Albrechtsen[1] MJ Arnedo[2], J Appels[3], D Baquero[4], B Galofré[2], B Lindhardt[5], C Puigdomènech[4], CO Lee[1], FB Wagner[1]

[1]Technical University of Denmark; DTU Environment, Bygningstorver, 2800 Kgs. Lyngby, Denmark.
[2]Aigües de Barcelona, Empresa Metropolitana de Gestió del Cicle Integral de l'Aigua, SA. Carrer General Batet 5-7, 08028 – BARCELONA
[3]microLAN, Biesbosweg 2, 5145 PZ WAalwijk, The Netherlands
[4]Cetaqua, Water Technology Center, Ctra. d'Esplugues, 75, 08940 - Cornellà de Llobregat, BARCELONA
[5]Nordvand A/S, Ørnegårdsvej 17, 2820 Gentofte, Denmark

Microbial contamination is a major threat to drinking water quality, and monitoring the microbial water quality is a way to ensure good and safe drinking water. However, grab sampling and long incubation times for growth based methods may lead to late responses (several days) which may be too late to allow for relevant correcting actions. This calls for methods which can provide results rapidly - ideally in nearly real times. Microbial water quality is not restricted to pathogens or indicator organisms, since increased microbial numbers and activity may reflect the management and functionality of microbial processes in the treatment such as back washing of biological rapid sand filters. Furthermore they may become essential in distribution systems to monitor the efficiency of the disinfection or in cases without disinfection residual where reparations of pipes, stagnant water or ingress of water in case of leakages challenge the water quality.

Several approaches have been taken to monitor the microbial water quality - one is a biochemical parameter Adenosine TriPhosphate (ATP), since it is an energy carrier molecule present in all living cells. Monitoring of ATP in drinking water is a promising technique because firstly, ATP is an indicator of total microbial activity, meaning that only active microorganisms are detected, and the detection is not restricted to a specific microbial type. Secondly, ATP analysis can provide results in few minutes, creating a great potential for real time monitoring. We have successfully demonstrated the use of ATP as a measure for ingress of contaminating water in the drinking water system, and to monitor the effect of backwashing rapid sand filters.

Another approach is to monitor enzyme activity in terms of Alkaline Phosphatase (ALP) which is produced in most microbial cells and which can use 4-Methylumbelliferyl-Phosphate (MUP) which is a Flourescent substrate. This is measured in a fully automated instrument BACTcontrol (microLAN) with a total measuring time of 40 minutes and where the phosphatase activity was determined by measuring the fluorescence associated with the formation of 4-methylumelliferone (MUF).

We are comparing these two approaches: the BACTcontrol Total Activity online analyzer and ATP analysis as well as other viability assays through simultaneous measurement at two different water companies: Aigües de Barcelona (AB), and Cetaqua, Spain, and Nordvand, Gentofte, Denmark. The eight-month long investigation includes including both the drinking water treatment plant and the distribution network i.e. multi-source chlorinated tap water from Barcelona DN and three types of process water from DWTP (sand-filtered water, GAC-filtered water and treated water) as well as biologically treated ground water.

This project is an ongoing work and further validation and optimization are supported by the EU granted project Aquavalens.